A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 53103

B.E./B.Tech. DEGREE EXAMINATION, MAY 2018

Third Semester

Civil Engineering

15UCE303 - MECHANICS OF SOLIDS - I

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5x 1 = 5 Marks)

1. Modulus of rigidity may be defined as the ratio of CO1- R

   (a) linear stress to lateral strain (b) lateral strain to linear stain

   (c) linear stress to linear strain (d) shear stress to shear strain

2. Mohr's circle is used to determine the compound stresses CO2- U

   (a) graphically (b) analytically (c) physically (d) numerically

3. What is the formula to be used for the calculation of statically indeterminacy of 2D trusses? CO3- R

   (a) m + r – 2j = 0 (b) m - r – 2j = 0 (c) m - r +2j = 0 (d) -m + r – 2j = 0

4. Bending moment at supports in case of simply supported beam is always CO4- R

   (a) less than unity (b) more than unity (c) zero (d) infinity

5. Leaf springs are subjected to CO5- R

   (a) shear stress (b) direct stress (c) bending stress (d) none of these

PART – B (5 x 3= 15Marks)

6. What are the two main conditions to be met for composite bars and write few example for the composite bars? CO1- App

7. Define principle stresses and principle plane. CO2- U

8. What are the assumptions made in finding out the forces in a frame? CO3- U

9. What are the types of beams and loads? CO4- U

10. Write down the torsion equation CO5- U

PART – C (5 x 16= 80Marks)

11. (a) A brass bar, having cross – sectional area of 1000 mm^2, is subjected to axial forces as shown in figure 1. CO1-App (10)

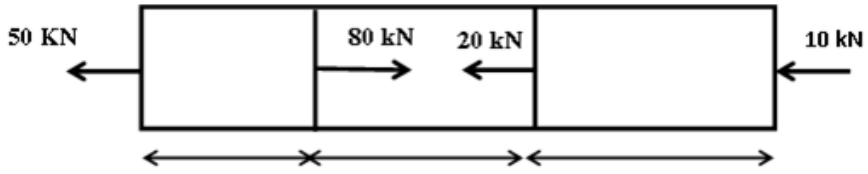


Figure 1

Find the total elongation of the bar. Take $E = 1.05 \times 10^5$ N/mm^2.

(ii) A square steel rod of 25 mm x 25 mm in section is to carry an axial load of 100 kN. Calculate the shortening in a length of 60 mm. Assume E= 2.1 x 10^8 kN/m^2 CO1-App (6)

Or

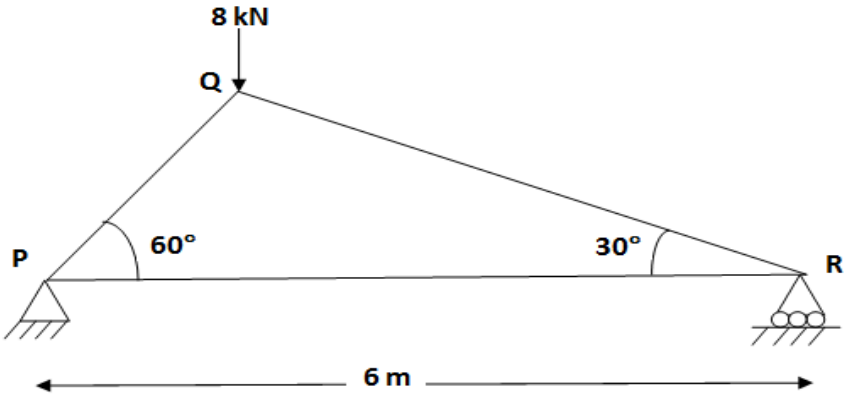
(b) The following observations were made during a tensile test on a mild steel specimen of 40 mm diameter and 200 mm long : CO1 -App (16)
Elongation with 40,000 N load (within the limit of proportionality) = 0.0304 mm
Yield load = 165,000 N
Maximum load = 245,000 N
Length of the specimen at fracture = 252 mm
Determine yield stress, the modulus of elasticity, the ultimate stress and the percentage of elongation.

12. (a) Two principal stresses at a point in a bar are 200 N/mm^2 (tensile) and 100 N/mm^2 (compressive). Determine the resultant stress in the magnitude and direction on a plane inclined at 60 degree to the axis of the major principle stress. Also determine the maximum intensity of the shear stress. CO2 -App (16)

Or

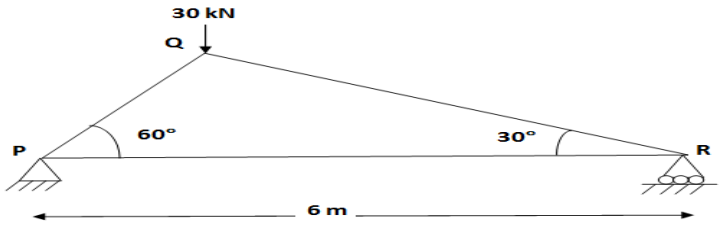
(b) At a point in a bracket, the stresses on two mutually perpendicular planes are 40 N/mm^2 (tensile) and 20 N/mm^2 (tensile). The shear stress across these planes is 10 N/mm^2. Find using Mohr stress circle, the magnitude and direction of the resultant stress on plane making an angle of 30 degree with the plane of the first stress. Find also the normal and tangential stresses on this plane. CO2 -App (16)

13. (a) A truss PQR shown in figure 1 has a span of 6 m. It is carrying a load of 8 kN at its apex. Find the forces in the members PQ, QR and RS by method of joints. CO3- App (16)

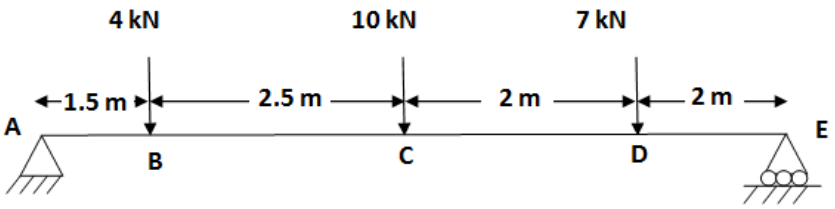


Or

(b) Find the forces in the members AC and AB of the truss loaded as shown in figure 2 using methods of sections. CO3- App (16)



14. (a) Draw the Shear force and the bending Moment diagrams for the simply supported beam loaded with the number of concentrated load shown in figure. CO4-U (16)



Or

(b) (i) A rectangular beam 300 *mm* deep is simply supported over a span of 4 *metres*. Determine the uniformly distributed load per *metre* which the beam may carry, if the bending stress should not exceed 120 N/mm^2. Take $I = 8 \times 10^6$ mm^4. CO4 -U (16)

15. (a) Design a suitable diameter for a circular shaft required to transmit 80.2KW at 180 r.p.m. The shear stress in the shaft is not to exceed 70MN/m^2 and the maximum torque exceeds the mean by 40%. Also calculate the angle of twist in a length of 2m. Take C = 90GN/m^2. CO5- App (16)

Or

(b) A close-coiled helical spring is to have a stiffness of 100 N/m in compression, with a maximum load of 45 N and a maximum shearing stress of 120 N/mm^2. The solid length of the spring is 45 mm. Find CO5- App (16)

i) The wire diameter

ii) The mean coil radius

iii) The number of coils.

Take modulus of rigidity of material of the spring = 0.4×10^5 N/mm^2